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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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AP1000 SUBCOMMITTEE

OPEN SESSION

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WEDNESDAY

APRIL 9, 2014

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 1:00 P.m., Harold B. Ray, Chairman, presiding.

COMMITTEE MEMBERS:

HAROLD B. RAY, Chairman

SANJOY BANERJEE, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR. Member

MICHAEL L. CORRADINI, Member

JOY REMPE, Member

PETER RICCARDELLA, Member

MICHAEL T. RYAN, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

DESIGNATED FEDERAL OFFICIAL:

PETER WEN

NRC STAFF:

DAN HABIB, NRO

ALSO PRESENT:

RICK AUSTIN, Westinghouse

MICHAEL CORLETTI, Westinghouse

TERRY SCHULZ, Westinghouse

SYLENA SMITH, Westinghouse

RICHARD WRIGHT, Westinghouse

*Present via telephone

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P R O C E E D I N G S

1:04 p.m.

Welcome and Introduction

CHAIRMAN RAY: The meeting will now come to order. This is a meeting of the ACRS AP1000 Subcommittee. I'm Harold Ray, chairman of the Subcommittee. With us this afternoon are members Pete Riccardella, Dennis Bley, Gordon Skillman, John Stetkar, Ron Ballinger, Charles Brown and Joy Rempe. Peter Wen of the ACRS staff is the Designated Federal Official for this meeting.

This is an informational meeting, to review AP1000 condensate return design changes and supporting analyses. We'll hear presentations from Westinghouse. I understand the staff's SE is not available at this time, and that Westinghouse has not yet been able to reply to the staff's RAIs.

At present, we do not have any further actions scheduled on this matter. This meeting was requested based on the numbers of parties potentially affected by the agency's actions on these design changes, and the desire for the ACRS to be informed at this point in time, concerning the bases for them.

As shown on the agenda, some presentations will be closed. In fact, the majority of them will be,

in order to discuss information that is proprietary to Westinghouse, pursuant to 5 U.S. Code 552-B(c)(3) and (4). Attendance at this portion of a meeting dealing with such information will be limited to the NRC staff, Westinghouse, and those individuals and organizations who have entered into an appropriate confidentiality agreement with Westinghouse.

Consequently, we will need to confirm that we have only eligible observers and participants in the room, and closure of the public phone line will occur for that portion of the meeting. The phone line is open now, and I, in a little unusual measure, I will invite any comments before we close the line, and before we enter the proprietary session, because the duration of that session is hard to predict, if anyone on the bridge line at all.

So I invite any comments from members of the public who are here. I can't predict how long it will then be suspended, due to the proprietary information. So I want to make it possible for any comments to be provided to the Committee prior to the line being closed.

The rules for participation in today's meeting have been announced, as part of the notice of this meeting previously published in the *Federal*

Register. The detailed procedures for the conduct of and participation in ACRS meetings were published in the *Federal Register* on November 8, 2013. We have received no written comments or requests for time to make oral statements from members of the public regarding today's meeting. Nevertheless, as I say, I will invite such comments shortly.

The transcript of the meeting is being kept, and will be made available as stated in the *Federal Register* notice. Therefore, we request the participants in the meeting use the microphones located throughout the meeting room when addressing the Subcommittee. Participants should first identify themselves and speak with sufficient clarity and volume, so that they can heard.

Westinghouse, members of the Westinghouse team are listening in on a non-public phone line, and we will be able to refer any necessary questions or requests for information to them if needed.

All that now having been said, we will proceed with the meeting, and I call on Don Habib of the NRC staff to make some initial comments.

Staff Opening Remarks

MR. HABIB: Good afternoon. My name is Don Habib. I'm a project manager in the Office of New

Reactors. I'm responsible for managing the AP1000 condensate return design change, the staff review. I'm providing a little bit of background and the current status of the staff review.

The staff became aware of the design change in discussions with Progress Energy Florida and Westinghouse about early 2013. Since that time, Progress Energy has merged with Duke Energy. This is part of the Levy COL review. Duke provided the first submittal related to the design change in April 2013, as part of the Levy COL application.

The staff began the initial submittal at the time, but the review was limited in 2013 because some of the key calculations and analyses underlying the submittal were not completed or available. In completing the analyses, Westinghouse had made further modifications to the design change.

These key analyses and calculations became available to the staff in January of this year, and in February we received an updated submittal under the Levy COL docket. In March, the staff issued an initial set of RAIs, and the staff's currently waiting for the response. A second set of RAIs we expect to issue this week.

While the Levy COL is the only application

to have submitted a design change, the staff expects this same design change to be made to all the other active AP1000 plants, including both the applicants and the licensees. For Vogtle and Summer licensees, we expect those license amendment requests very soon.

Currently, our schedule provides that the staff review is going to be completed in September of this year.

CHAIRMAN RAY: And the SE issued then Don?

MR. HABIB: We'll have an advance SE, no open items, in September. That's the current schedule.

CHAIRMAN RAY: All right, and you -- we'll request the second set of RAIs be made available to our staff when they're issued, if you will, so we can keep current.

MR. HABIB: Okay, will do.

CHAIRMAN RAY: That's what we're trying to do. That's the reason for this meeting, is to avoid any unnecessary or avoidable delay in the review. Anything else?

MR. HABIB: That's it. Thank you.

CHAIRMAN RAY: Okay. With that, as I said, before we -- well, does Westinghouse have comments? You do have, according to my agenda anyway,

comments to make prior to our closing the meeting. So please proceed with that portion of your presentation.

MR. CORLETTI: Good afternoon.

CHAIRMAN RAY: Good afternoon.

Westinghouse Opening Remarks

MR. CORLETTI: My name is Mike Corletti, AP1000 Plant Design Division, Engineering Director at Westinghouse.

On behalf of Westinghouse, I want to say thank you for providing us the opportunity to speak to the ACRS today. I'll just introduce some of the members we brought with us. We have Mr. Schulz, who's our consulting engineer, responsible for the passive safety systems design. He'll be doing the majority of the presentation today.

We also have Dr. Rick Wright, representing -- who will be presenting some of the testing and analysis that we've done associated with this change. We also have Mr. Tom Gear, Vice President of New Plant Engineering and Licensing, and Mr. Paul Rust, Director of U.S. Licensing and Regulatory Support. They'll be the primary speakers for today's discussion.

In this regard, we've provided -- I know we have an agenda. We provided one to maybe help you, if you want to keep us -- to keep us on track with our

presentations, and when you may want to break.

CHAIRMAN RAY: All right.

MR. CORLETTI: It follows yours, but it just provides -- subdivides it a little bit. So I can hand that to you.

CHAIRMAN RAY: There we go. I've got it in hand now. Thank you.

MR. CORLETTI: Right, in the interest of keeping us all on track. So next slide please, and this is what I just handed out to you. So we can adjust as necessary. Okay. So for the purpose of this meeting, this is a really an opportunity for us to explain an issue with the containment condensate return that we've been working on really for several years, in resolving an issue that we've identified.

It really deals with the design of how condensate returns to the IRWST during long term operation of the passive RHR heat exchanger, and I'll talk a little, to get us all oriented on the role of the passive RHR heat exchanger in some of the next few slides.

We're going to talk about the issue. We'll review design changes that we're making to improve the performance of the system, and we're going to review the calculations and analysis that we've

done, and the testing that we've done that forms the basis for those calculations analysis, that are part of the submittal that has been provided as part of the COL application for Levy, as well as the future plan submittals for license amendment requests for V.C. Summer and Vogtle.

Again, the agenda. The initial portion is what I'm speaking to now. The overview on the passive RHR heat exchanger operation, and then the more detailed presentations, the plant safety -- the systems operation, the design changes that we've made in detail, detailed review of the analysis and then the condensate return testing that we've performed in support of this new design.

Okay. But just -- since it's been maybe two years since we've had the opportunity to be here, we thought we'd just go over again the fundamentals of the passive RHR heat exchanger operation. Really, the heat exchanger is a -- is designed for decay heat removal in non-LOCA events, events such as a loss of normal feed or a station blackout.

It's a heat exchanger that's located in a large pool of water called the in-containment refueling water storage tank. That's located above the core, and so it allows for natural circulation, decay heat

removal for -- on indications of loss of decay heat, such as low steam generator water level.

It takes -- during operation, it will take roughly four hours for the IRWST to heat up the saturation. Beyond that, steam will be produced in the IRWST and is discharged into the containment, and through operation of the passive containment cooling system, steam would be condensed on the containment shell and returned to the IRWST through a series of gutters and down spouts, that are designed to collect that condensate and really maintain that passive heat sink for a long period of time.

Again, this was -- keep going back. Most steam is condensed on the containment shell. However, the steam also goes into heating up the heat sinks, heating up the metal throughout the structure, and some that does not return to the IRWST would collect in the lower portions of the containment, eventually the containment sump and eventually contribute to our flood-up level for events such as a LOCA-type event.

Okay, next slide. This is another picture that really shows how the steam that is produced in the passive RHR or by the passive RHR operation condenses on the containment shell. As you recall, passive containment only has three days of heat removal.

Beyond three days, we have onsite ancillary water storage tank, passive containment cooling refueling water storage tank that would replenish that tank, to provide at least seven days of cooling with onsite. Beyond that, we have hookup connections for temporary equipment to provide continued long term operation of the passive core cooling system or the passive RHR in such a non-LOCA type scenario.

So it is important that the condensate return, while it influences maybe the shorter term behavior, really comes into account in the longer term, the three days, ten days, 14 days, that that the rate, the rate of condensate return, would affect how long that you may have the IRWST as a heat sink for passive RHR.

Most of this -- as I said, most of the steam condenses on the containment vessel, and is captured by a gutter system that we've designed to collect that condensate and return it to the IRWST.

MEMBER BANNERJEE: The gutter system moves around the whole wall, right?

MR. CORLETTI: Yes it does. It goes around the containment vessel completely.

MEMBER BANNERJEE: Completely, correct.

And how wide is the gutter?

MR. SCHULZ: It's about four inches.

MEMBER BANNERJEE: Four inches.

MR. SCHULZ: Four inches. It's located right at the operating deck, and then the IRWST is just below that.

MEMBER BANNERJEE: Okay, thanks. You're going to show us diagrams?

MR. SCHULZ: We'll show you some more detail later on.

MEMBER BANNERJEE: Yes, right.

MR. CORLETTI: If you go to the next slide. With regards to -- we're going to get into a lot of the details on the gutter system, and all the contributions for the losses.

MEMBER BANNERJEE: So Terry's going to do that?

MR. CORLETTI: Yes. With regards to, you know, what would be the acceptance criteria with regards to the operation of the passive RHR heat exchanger long term, our licensing commitment is that the RHR can cool a reactor coolant system down to a temperature of 420 degrees in 36 hours.

Now this is -- now we would say this is a licensing commitment. It really doesn't represent a

safety state, the current safety limit. But it is our licensing commitment. If the temperature would be somewhat higher, there's not a cliff effect. It doesn't -- it's not really a safety issue, but it is a licensing commitment.

MEMBER CORRADINI: Is that just a saturation temperature at some pressure?

MR. CORLETTI: That represents essentially the RCS pressure or RCS temperature. It's not going to be saturated though; it will be somewhat --

MR. SCHULZ: Well, it eventually it becomes saturated. I'll show later on some specific --

MEMBER CORRADINI: Because at 36 hours, that's a saturation temperature of some pressure, right?

MR. SCHULZ: Yeah. It's about 310 degrees absolutely pressure, psiA at 420 (ph). It's a saturated temperature.

CHAIRMAN RAY: Mike, we're in -- you came in late. We're in a public session now briefing. We'll transition to proprietary.

MEMBER CORRADINI: Okay, but the steam tables is public. I can look up the saturation

pressure --

(Simultaneous speaking.)

CHAIRMAN RAY: Absolutely. Mike, that wasn't my point at all.

(Laughter.)

CHAIRMAN RAY: I'd like to know if you want to ask more questions --

MEMBER CORRADINI: No, no, no. One is enough.

CHAIRMAN RAY: The time will come. Good. Go ahead.

MR. CORLETTI: And --

MEMBER BANNERJEE: You carry the steam tables?

MEMBER CORRADINI: Yeah.

CHAIRMAN RAY: An engineer does that. Where's yours?

MEMBER BANNERJEE: On my computer.

(Simultaneous speaking.)

CHAIRMAN RAY: Sorry.

MR. CORLETTI: Very good. Just to remind us, that in loss of coolant accidents, passive safety injection with ADS, while automatic to pressurization, will achieve and maintain safe shutdown. Again, that requires in -- all these events for longer than 72

hours, we require replenishment of the passive containment cooling water storage tank with water, either with our onsite sources or with our offsite sources.

It's noted that the PRH, that these features are also diverse to the passive RHR heat exchanger, which is important in PRA and in probabilistic risk assessment.

So just a little bit of the background of the issue. We really recognized a couple -- two major things in detailed design implementation, that really caused us to revisit this. Number one, the analysis that was done for the certified design assumed a constant condensate return rate. As we really recognized as we did more work, that really is a simplification, and as you can imagine, initially steam is produced in the RWC.

It's not going to condense. It's going into heating up the heat sinks and it takes a period of time before the condensate actually starts coming back to the IRWST. So it's not a constant rate, that you'll have very low condensate return initially, and then as the transient goes on, you'll get a higher condensate return rate.

So that was one thing that we needed -- that

we felt needed to be corrected in the analysis. The other is --

MEMBER BANNERJEE: Does it make any difference when it comes?

MR. CORLETTI: So in the short term, it doesn't make a difference. In our Chapter 15 accident analysis, it did not really impact the safety limits for those events. It does -- the transient changes, the behavior changes, and it could have an impact on the long term. So the transient might look different.

MEMBER BANNERJEE: So you're going to tell us how this varies with time?

MR. CORLETTI: Yes, we are. Okay, and the other -- the other is that we recognize through detailed design, design implementation, as we make especially things like piping supports and HVAC supports and electrical supports, that we've used the containment shell as a convenient way to support these commodities inside containment, that those supports can cause a loss, can cause an interruption in the flow of condensate that perhaps wasn't envisioned when we did the certified design.

So now that we have -- we're building these plants, the design is essentially complete. We're able to characterize that and characterize those

losses, and ensure that we can still meet the certified requirements of our licensing basis.

So when we recognized that, we initiated a study to fully characterize and quantify the condensate return rate, and through that we did calculations and analysis, and then we have done testing to better characterize those losses, losses over the attachment plates or other things that may be attached to the containment.

Then we provided detailed analysis of thermodynamic behavior during steam on the condensation, to get that variable rate return. I think -- and really we've done that probably through a longer time period than perhaps we did before.

So with that, the studies that we completed really showed that while the Chapter 15 limiting accident, the conclusions weren't impacted, the shutdown evaluation that is provided in DCD Chapter 19E shutdown, was impacted, and although the plant would still be safe, we weren't meeting those licensing requirements as required, the core bound of 420 in the 36-hour time frame.

MEMBER CORRADINI: Can you say that again please? I'm sorry.

MR. CORLETTI: So what I said is what we

said when we incorporated this -- the new, the variable return rate, and also taking into account the various attachments and the higher losses, while our Chapter 15, the conclusions of our design basis accident in Chapter 15, the limiting conclusions weren't affected. The analysis in Chapter 19E, which is our evaluation of long-term cooling using the passive RHR heat exchanger, was impacted.

So the analysis at 19E was no longer, without the exchanges was no longer. So the decision was made to improve the condensate return, and we're going to go into details.

MEMBER BANNERJEE: So was this primarily due to the holdup or in various components or places or --

MR. CORLETTI: I think primarily it was the holdup. I think the variable rate probably is more transient.

MEMBER BANNERJEE: It doesn't matter, yes.

MR. CORLETTI: You get to the same point eventually. I think the higher loss is due to the additional attachments, is probably more of an effect.

MEMBER BANNERJEE: Uh-huh.

MR. CORLETTI: So one -- and we're going

to show details of changes that we evaluated on the polar crane. The polar crane is a place where condensate would collect, and it's designed to collect there and return to the containment shell. I think we've made improvements to actually put a gutter collection system on there to return that to the RWC directly.

Now with the changes that we're proposing, that we are incorporating, the plant performance is now consistent with our Chapter 19E shutdown temperature evaluation. Essentially, we're restoring the plant to the conditions in the certified design.

MEMBER BANNERJEE: How much water are we talking about?

MEMBER CORRADINI: I don't think they can say.

MR. WRIGHT: We'll, in the more detailed presentation --

MEMBER BANNERJEE: Oh, sorry. I didn't realize we are in open session.

MR. WRIGHT: Okay.

MEMBER BANNERJEE: Why can't we just go into closed session?

CHAIRMAN RAY: Give me a chance here, please. Go ahead, gentlemen.

MR. CORLETTI: Okay. So this -- I think this was summarized pretty well by the NRC staff. But here is a summary of the licensing actions, that we confirmed the need to modify the design in January of 2013, and we performed what we call an ISG-11 screening, which really decides whether we need to include this in an applicant's COL or not, and we concluded that we did, and there we informed the NRC that it was going to be included in the Levy COL application.

We completed the calculations and testing and analysis, and we're going to be presenting those today, and we have submitted the update to the COL in February. We are also going to be making these same changes for the plants under construction, Vogtle and V.C. Summer. We've had an initial meeting on the Vogtle LAR. Those will take the form of a license amendment request for both of those.

Just to give you an idea of the scope of what's changed, this really just -- but this lists the various portions of the FSARs that will be updated by this change. I think that's the end of that section. That really concludes my -- the open portion of the Westinghouse presentation.

CHAIRMAN RAY: Let me ask this question.

On that list, how much of the information that is on this tabular form is Tier 1?

MR. CORLETTI: None of it. None of that is Tier 1. Is any Tier 1 information impacted? Sylena?

MS. SMITH: Yes.

CHAIRMAN RAY: Wait. You have to identify yourself please.

MR. CORLETTI: Step to the microphone there Sylena, and identify yourself.

MS. SMITH: Yes. This is Sylena Smith. I'm with Westinghouse. The PXS pipelines table, the pipelines that have to be qualified, there's some additional pipelines added to that table. In addition, there are eight great screens that are added to the safety-related components table in the -- so that would be the Tier 1, 3, 2. Yeah, the passive core cooling system.

MR. CORLETTI: Okay. So just to be clear, this is the Tier 2 information that's impacted, Sylena. This is not Tier 1 information.

MS. SMITH: That is the Tier 2 information, that's right.

MR. CORLETTI: Right. But I think what we're explaining is there are -- because of the changes

to the gutter system, we've added some pipelines that are now will be included in the Tier 1 information.

MEMBER SKILLMAN: Will we talk about that in a closed session?

MR. CORLETTI: Yeah, and we can talk about here in the open session as well. It will be public. But there will be a certain set of pipelines that are associated with the down spouts, that we're adding. It's adding into Tier 1. So we're adding additional Tier 1 information, and they meet the criteria for Tier 1 that we're adding, to identify these are important safety pipelines.

MEMBER SKILLMAN: They will be important to safety pipelines?

MR. CORLETTI: Well, I think that's our criteria for having something in Tier 1. Tier 1 it's a graded approach, how much should be in Tier 1, and we at least propose putting them in Tier 1.

MEMBER SKILLMAN: Well, if you didn't put them in Tier 2 star, you put them Tier 1. It sounds safety stuff.

MR. CORLETTI: Yeah. Well so there's -- not everything safety is in Tier 1. Tier 1 is the ITAAC. So this one will be something that will have to be confirmed that it's built correctly, in order to

-- and it would be one of the ITAACs that we would propose.

MEMBER SKILLMAN: Thank you.

CHAIRMAN RAY: Anything else from members?

(No response.)

CHAIRMAN RAY: Okay. With that, as I said, because I can't forecast how long we'll be offline, as far as the phone line is concerned, let me inquire -- and our phone line is open, even though it hasn't been popping and cracking, which is usually the indication that it's open. Is there anyone on the phone line who would like to make a comment at this time?

(No response.)

CHAIRMAN RAY: I hope they're not out there hollering at us, like yes --

MEMBER STETKAR: It was popping and cracking earlier, and then it became silent, which is curious.

CHAIRMAN RAY: Better go see why, ask if there's anyone in the audience. Just confirm that the phone line's open. Is there anyone here in the audience who would like to make comments at this time, before we close the meeting?

(No response.)

MEMBER BANNERJEE: Maybe Terrell (ph) did some magic.

CHAIRMAN RAY: Magic happens for some things, but not the phone line I'm afraid. Okay. As soon as we confirm that all is well with the phone line, we will close the meeting here and proceed. Let's assume that the phone line is --

(Phone sound.)

MALE PARTICIPANT: Oh, that's an indication.

Public Comments

CHAIRMAN RAY: It is indeed. Again, is there anyone on the phone line who wishes to make a comment before we close the line?

(No response.)

CHAIRMAN RAY: Hearing nothing from the phone line then, we will now close it, and we will also ask that those who can do so, verify that the audience here in the meeting room is limited to those who met the criteria I said before.

(Whereupon, at 1:33 p.m., the meeting was adjourned to closed session.)

O P E N S E S S I O N (resumed)

4:52 p.m.

CHAIRMAN RAY: As I said at the outset, we have no further deliberation presently scheduled. But I do believe we will have benefitted a great deal from this session, and I hope it benefits the project overall at the end of the day.

With that then, I'm going to ask, because we need to do this very deliberately, that we go back into open session, which I guess is going to force us to close the Westinghouse line, and I don't think there will be anybody on the public line that was noticed. But we'll give it a choice anyway.

MEMBER BANNERJEE: So out of this one point, could we at some point, I don't know exactly how, get at least some feedback on the results of this experimental program, whether -- you don't have to come to the committee, but I think it would be nice to get the results?

CHAIRMAN RAY: Yes. We'll take note of that, Sanjoy. I believe that as things go forward here, we'll find that there's going to be an opportunity to review the SE from the staff, regardless, and at that point, the test data I presume would be part of that

review and presentation by whichever ICC it is that we're talking to.

MEMBER BANNERJEE: Oh, I see. Which way is it going to come to us?

MR. SCHULZ: It's not our current plan.

CHAIRMAN RAY: What was that?

MR. SCHULZ: It's not our current plan. What we're saying is that we don't need test data.

CHAIRMAN RAY: Oh, I see, okay. All right, that's a good point.

MR. SCHULZ: For future margin recovery, not current.

CHAIRMAN RAY: I understand your point. All right then. We'll take that as an action, Sanjoy. I don't want to try and complete that transaction here.

But Sanjoy's asked if the tests that were described at the end of the presentation, with the tanks, with the windows and all that, if we could come to understand how those test data might be available for review later on. I don't want to try and ask you to respond to that now.

MEMBER BANNERJEE: It doesn't even have to be reviewed. It's just informational.

CHAIRMAN RAY: Review for our

information.

MR. CORLETTI: We'll find a way to do that.

CHAIRMAN RAY: Okay, that's fine.

MEMBER REMPE: In addition, Sanjoy asked during the meeting about nodalization diagrams, the initial analysis and the final, and if he could follow up on that.

CHAIRMAN RAY: Yes. That is pertinent to the present discussion, because we're relying on the new analysis. He asked a question about comparing the nodalization of before and after. So we'd want to do that.

Again, I'm kind of in an odd position here of not being able to foresee exactly when we're going to take the next step here. But I think whenever it is, we'll have benefitted from this meeting. The line's open? Huh?

MR. WEN: The open line is gone.

CHAIRMAN RAY: Okay. There's nobody on the line? Okay. We'll put that in the record then, that we opened the line and there was no one there. I didn't expect that there would be, so I'm not surprised by that. Don, you have anything more you want to say?

MR. HABIB: I just wanted to thank the

Committee for taking the time to give us this opportunity to have this meeting. It certainly is beneficial for the process that we're in right now.

CHAIRMAN RAY: Okay, and we will have to work out, so I can share with the Committee what to expect to happen going forward. I know the existing COLAs will just be processing amendments, and that it isn't on our agenda, and anything beyond that we don't really know about yet.

But I think this is unique enough, that maybe that is something that will be decided on, in terms of being able to take this to the full committee and bring it to closure. Anything more? If not, we're five minutes ahead of the schedule I was given, and so we'll consider ourselves adjourned.

(Whereupon, at 4:54 p.m., the meeting was adjourned.)

Westinghouse ACRS UPDATE 04-09-14

"Changes to Passive Core Cooling System Condensate Return"

Westinghouse

Purpose

- Explain issue with containment condensate return to In-containment Refueling Water Storage Tank (IRWST) for long-term Passive Residual Heat Removal (PRHR) operation after station blackout event
- Review design changes to improve the containment condensate return to the IRWST
- Review calculations/analysis status that support the long-term PRHR HX decay heat removal operation
  - Each calculations purpose, methodology, and results

Westinghouse

AGENDA*

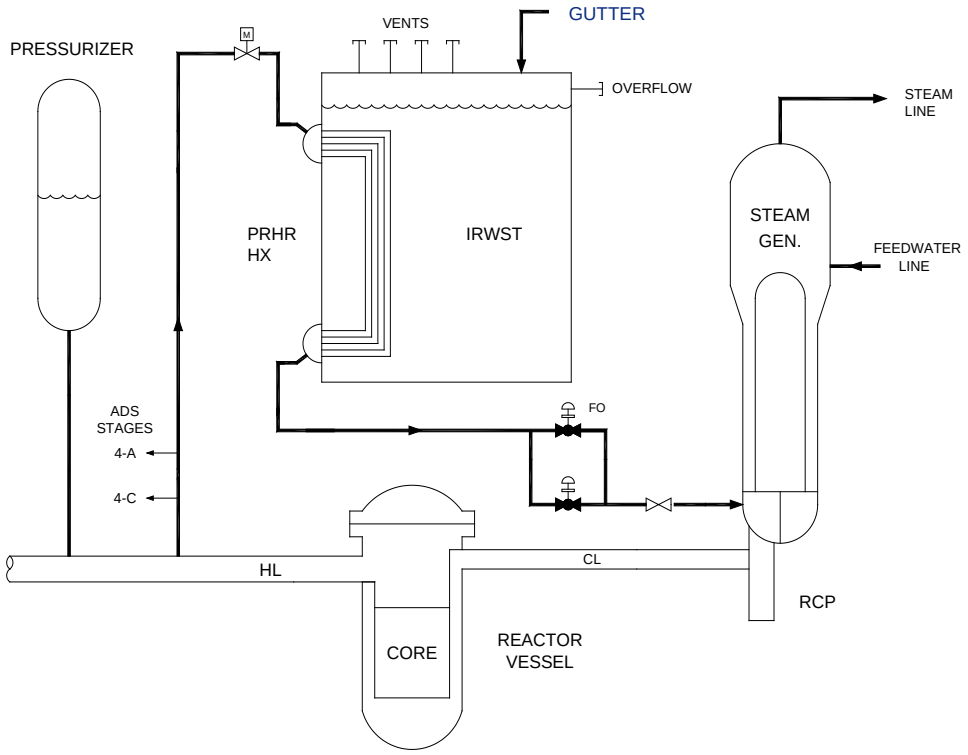
- Overview of long-term PRHR HX operation*
  - Includes summary of issue, plant changes, licensing actions
- **AP1000** plant safe shutdown systems / operation
- Design changes to improve containment condensate return to IRWST
- Analyses performed to support long-term PXS operation:
  - Each calculations purpose, methodology, and results
- WEC condensate return testing

* Open portion of meeting only includes first item

Westinghouse

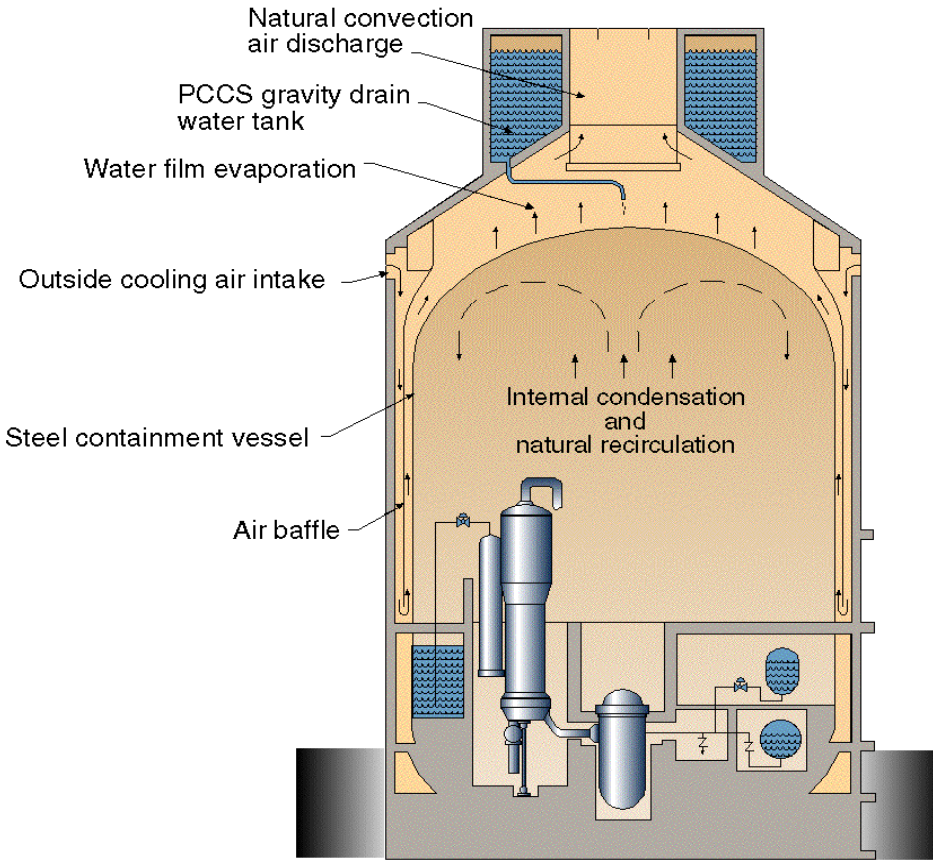
PXS Safety Design Description: non-LOCA Operation

- During non-LOCA events PRHR HX transfers heat from RCS to IRWST
  - Takes ~4 hours for IRWST to heat up to saturation and start steaming
  - Steam is discharged from IRWST to containment through vents in IRWST roof
  - Most steam condenses on containment vessel (CV) and returns to IRWST via gutter



PXS Safety Design Description: non-LOCA Operation

- Steam from IRWST increases containment pressure causin actuation of passive containment cooling
- Most of the steam condense containment vessel (CV)
- Condensate flows down containment walls and back i IRWST via gutter
- Some steam lost to
  - Pressurizing containment
  - Condensation on walls/floo
  - Condensate dripping / spla from CV



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AP1000 Plant Safe Shutdown

- In non-loss of coolant accident events, the PRHR HX will bring the plant to safe shutdown and maintain this condition
  - **AP1000** plant safe shutdown defined as reactor coolant system (RCS) temperature ≤ 420°F in 36 hour
  - This temperature does not represent a plant safety limit
    - If the RCS temperature is somewhat higher it would have no consequences
- In loss of coolant accidents, passive safety injection and ADS will achieve and maintain safe shutdown for an unlimited time
  - With support required for PCS after 72 hours
  - These features also provide diverse safety-related backup to PRHR HX operation

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Technical Issue: Identification

- During detailed design implementation Westinghouse identified the need to revisit the technical basis for the condensate return rate
  - Condensate return rate varies with time
  - Additional mechanisms for condensate loss were identified or better quantified
- Westinghouse initiated a study to fully characterize and quantify condensate return rate
  - Testing performed to quantify losses due to physical features on CV
  - Analysis of thermodynamic behavior during steaming and condensation undertaken

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Technical Issue: Quantification

- Westinghouse test / analysis results:
  - Condensate return rate was lower than assumed in the DCD Chapter 19E shutdown temperature evaluation using the PRHR HX
  - Plant would still be safe, however the Chapter 19E shutdown temperature evaluation would not be bounding
- Decision made to improve gutter system condensate return
  - Use polar crane girder (PCG) and stiffener as intermediate level gutters and add downspouts to transfer directly to IRWST
  - Modify operating deck gutter to reduce losses
  - Allows plant to meet safe shutdown temperature / time (Chapter 19E)

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Summary of Licensing Actions

- January 2013
  - Westinghouse confirmed need to change standard design
  - Duke Energy and Westinghouse ISG-011 evaluation confirmed need to inform NRC prior to Levy COL
- January 15, 2014
  - Westinghouse calculations for license submittal complete
    - Containment response analysis for long term PRHR operation
    - Condensate return to IRWST for long term PRHR operation
    - PRHR sizing / performance
    - **AP1000** plant safe shutdown temperature evaluation
- February 7, 2014
  - Levy exemption request update submitted
- March 20, 2014
  - Vogtle pre-submittal meeting held

COL Applicant/Holder Licensing Basis Impacts

- Part 2 – Final Safety Analysis Report (FSAR)
  - Chapter 1, Table 1.8-201, Summary of FSAR Departures from the DCD
  - Section 3.2, Classification of Structures, Components and Systems
  - Section 3.8, Design of Category 1 Structures
  - Section 5.4, Component and Subsystem Design
  - Section 6.3, Passive Core Cooling System
  - Section 14.3, Certified Design Material
  - Chapter 19E, Shutdown Evaluation
- Part 4 – Technical Specifications
  - Change to Tech Spec bases only